COMMENTS ON DRAFT BRISTOL BAY WATERSHED ASSESSMENT
(Docket #EPA-HQ-ORD-2012-0276)
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23 July 2012

INTRODUCTION AND RATIONALE

I am a retired scientist with a background in wetland ecology, ornithology, environmental toxicology, and wildlife management. I strongly urge the EPA to evaluate impacts on wildlife in the Bristol Bay watershed in the Bristol Bay Watershed Assessment (Assessment). Wildlife includes mammals and birds; I will comment only on birds, since they are within my expertise.

The Assessment contains no evaluation of the potential impacts of Pebble Mine on birds, other than a narrow category of indirect impacts through changes in fish prey.

The Assessment should include birds for the following reasons:

- Birds are a major component of wetland and upland ecosystems.
- Bird populations are sensitive to changes in habitat and to contaminants from mines.
- Among the reasons for denying a permit to dredge or fill, the Clean Water Act includes protection of wildlife from unacceptable adverse impacts. Wildlife includes birds.
- Migratory birds as a group are "Trust Species" of the federal government. The U.S. Fish and Wildlife Service is supposed to ensure their population stability and has taken legal action in cases of outright bird mortality associated with mines.
- Some species in the Pebble area are "Species of Concern" of government agencies and/or NGOs, because of declining populations in Alaska or worldwide.
- Bird kills are a known problem associated with pit lakes and tailings ponds.

The Assessment should consider various impacts on birds:

- Physical loss of habitats, due to alterations of stream flow and "dewatering" of the water table
- Indirect effects on birds from reductions in prey populations, due to habitat changes or contamination
- Direct ingestion of contaminants by water birds, via (a) contamination of groundwater and streams and (b) contact with toxic tailings ponds and pit lakes

MY BACKGROUND

Master's and PhD in zoology (behavior and population ecology of aquatic birds); research in avian toxicology; management and population monitoring of seabirds, waterfowl, and songbirds; preparation of plans and EISs for wildlife refuges; peer-reviewed publications; Certified Wildlife Biologist. I have lived

and worked in Alaska for 30 years. I have not been in the Pebble area, but I am familiar with similar habitats and avifauna from bird observations and monitoring around Nushagak Bay. I have no expertise hydrology or in the engineering and management of mine impoundments. However, I mention some problems that would affect birds but that appear not to have been considered in the Assessment.

BIRDS OF THE BRISTOL BAY WATERSHED THAT SHOULD BE CONSIDERED IN THE ASSESSMENT

Sources of information

Although the EPA Assessment says (Chapter 2) that little information is available on birds of the Bristol Bay watershed, this is not true at present. Pebble's Baseline Document (PLP 2012) includes detailed field surveys of birds and their habitats near the proposed mine.

The bird (and mammal) surveys were conducted by ABR, Inc. I suggest that the EPA should use ABR's wildlife data to upgrade the Assessment's evaluation of Pebble's impacts on the watershed. ABR is an experienced and respected environmental consultant; their outlets include peer-reviewed journals. Field teams conducted extensive inventories for two years at the proposed mine site and adjacent areas, documenting bird species and their habitats, density, breeding status, and in some cases, breeding success. Separate studies were done for land birds, raptors, and water birds in a study area that covered 1,135 km^2, including the proposed Pebble site. In my professional opinion, ABR used scientifically accepted methods, documented their methods and sources exhaustively, and produced scientifically sound data and conclusions. The report does not appear to have been biased by the fact that Pebble was funding the studies.

Aquatic birds that should be considered

ABR, Inc. reported on all bird species in the study area; however, since the EPA's focus is on wetlands, I will focus on wetland birds and other avian species that depend on them.

ABR recorded 38 species of aquatic birds that use streams, lakes, and/or ponds in the immediate area of the Pebble prospect. Breeding in the area was confirmed for 22 species, including Tundra Swan, 5 species of dabbling ducks, 5 diving ducks, Red-breasted Merganser, 2 species of loon, Red-necked Grebe, Sandhill Crane, 5 shorebirds, and two species of gull (ABR Inc. 2012,Table 16.4-2). Additional species use water bodies in the Pebble area during **migration** to rest renew their energy resources. ABR surveyed lakes over several days in spring and fall; maximum numbers of individuals seen in single surveys included over 950 ducks, 80 gulls and terns, and 40 shorebirds. Just outside the Pebble area on the Nikabuna Lakes, 357 swans and 954 ducks were recorded at one time (ABR, Inc. 2012, Tables 16.4-3, 16.4-10).

Many waterbird species that use the Pebble have healthy populations; however, several are **"Species of Special Concern"** because populations are declining throughout their range. These include the Harlequin Duck, Long-tailed Duck, Black Scoter, and Surf Scoter (ABR Inc., page 16.4-1).

Other bird groups that should be considered

Many "land birds" would be exposed indirectly to habitat changes or contaminants as a result of mining. The Assessment mentions that loss of fish could affect raptors such as Bald Eagles, but actual impacts could be far more widespread.

Several **predatory birds** recorded near the Pebble area depend on aquatic species. Raptors such as the Bald Eagle and Osprey, which prey on fish, would be impacted by changes in fish stocks or contaminants in their prey. Bald Eagles, Ravens, and gulls scavenge dead fish and could be similarly affected. Other raptors depend heavily on ducks and smaller birds as prey, including the Bald Eagle and Merlin (ABR Inc., page 16.3-5, Tables 16.3-3, 16.3-4).

Non-aquatic birds also could be exposed to loss of habitat due to changes in the water table, or if groundwater and streams are contaminated. Shrub habitats are necessary for many "land bird" species, and their highest diversity was found in shrubs of moist and wet ground (ABR Inc. 2012, Figure 16.1-3). Fifteen species of shrub-dependent songbirds and the Willow Ptarmigan were recorded near Pebble; the Gray-cheeked Thrush and Blackpoll Warbler are Species of Special Concern (ABR Inc. 2012, page 16.1-34, Table 16.5-3). Several shorebird species also inhabit moist tundra habitats.

LOSS OF BIRD HABITATS DUE TO MINING OPERATIONS

Although bird habitats would be destroyed within the "footprint" of Pebble Mine, the greatest concern may be widespread loss of bird habitats due to stream blockage and "dewatering." Streams would be intercepted or rerouted, and water would withdrawn by the mine itself (EPA 2012, pages 4-26, 4-27). Impacts would extend far down every affected stream. The water table also would be lowered over a large area due to water extraction for mining operations (EPA 2012, page 4-29, 4-31), and by pumping to minimize leaching of contaminated water (EPA 2012, page 4-26, 4-27). Moist tundra habitats and water bodies are maintained by ground water (Woody and Higman 2011); marshes, lakes, ponds, and streams would shrink or be eliminated, and moist tundra would change to different vegetation types.

Widespread loss of bird habitats appears inevitable if Pebble (and other mines) are permitted, which would impact bird populations. Dewatering and associated habitat impacts would be most severe if water tables were kept artificially low in order to minimize contamination of groundwater.

- **Marshes, ponds, lakes, and streams would be altered or eliminated** if streams were blocked and the water table was lowered. Water birds depend on these habitats to feed themselves, raise their young, as refuge during molting, and to rest and feed during migration.

- **Dewatering of groundwater would reduce or eliminate shrub habitats** of riparian and moist areas. This would reduce shrub-dependent bird populations. Shorebirds that feed and nest on moist tundra also would be impacted.

- **Reduction in bird populations would impact predators** that depend on birds for food, such as Bald Eagles in the case of waterfowl, and Merlins in the case of small birds.

TOXICITY OF MINE CONTAMINANTS TO WATERFOWL AND PREY FAUNA

Water birds would be at risk of ingesting lethal levels of contaminants if they came in direct contact with tailings ponds or pit lakes (discussed below). If water bodies in the area of Pebble Mine were contaminated, birds could ingest contaminants from the water or their prey.

Mallards suffered internal injuries or were killed when they drank typical mine water that was acidic (pH of 2) and that contained copper at concentrations of 594 milligrams per liter or higher (among other metals; Hooper et al. 2007). Contamination would probably be diluted in natural waters, but long-term exposure of birds to mine contamination has not been evaluated.

The prey of aquatic birds are much more sensitive to metal contaminants than are the birds themselves. The acute toxic level of copper to amphipods is only 9.6 micrograms per liter (EPA 2007).

INDIRECT IMPACTS OF WATERSHED CONTAMINATION ON BIRDS

Indirect impacts on birds via changes in prey populations

If contaminants leached from mine impoundments into streams (EPA 2012, page 6-38) even at low levels that did not injure birds directly, **it could be lethal to prey populations.** In addition, waters of ponds, lakes, and streams interchange frequently with groundwater, which can carry contaminants from a considerable distance (Woody and Higman 2011). Contamination would not be confined to water bodies; tundra streams flood in spring (ABR, Inc. 2012, page 16.1-36) and could contaminate "terrestrial" food webs.

Prey of aquatic birds (fish and invertebrates) are highly sensitive to metal contaminants and have been eliminated below many mines in the past (EPA 2012, page 6-41). If prey populations were reduced, or eliminated, this would impact birds. Survival of young birds would be most affected, since they depend almost exclusively on animal foods during early life. Songbirds and shorebirds would also be vulnerable, since their prey is most abundant in moist areas

Reduction of bird populations would in turn affect their predators. Bald Eagles are regular predators on waterfowl and other medium-sized aquatic birds; reductions in populations of prey populations would impact eagles in the Pebble Mine area.

Ingestion of contaminants via food

Aquatic birds consume fish and invertebrates, which could expose them to contaminants in the watershed. The prey of land birds are most abundant on moist tundra; shorebirds feed exclusively on insects and arachnids, and these are the principal foods of young songbirds and ptarmigan. Levels would probably be low, except in the vicinity of the mine; but effects of long-term exposure are not known. Raptors in the Pebble area, such as Bald Eagles and Ospreys, are predators on fish and could be exposed to contaminants via their prey. Scavenging birds such Bald Eagles, Ravens, and gulls could be exposed via dead fish.

DIRECT IMPACTS ON BIRDS OF TAILINGS PONDS AND PIT LAKES

Tailings ponds and pit lakes are a known hazard to aquatic birds. Birds are most likely to be directly poisoned in these impoundments, and bird kills have been documented in them. The Assessment discusses measures that Pebble could use to reduce risks from their impoundments, but their effectiveness is open to question.

Tailings ponds will probably contain extremely toxic water

The Assessment considers the possible toxicity of tailings storage ponds, including the dangers of leaching into groundwater. However, **there is no assessment of direct impacts of toxic water on wildlife, including birds**. Hazards to birds should be added to the Assessment.

Although the Assessment's scenario (Chapter 4) includes methods to reduce acidity and toxicity in pond water, **major factors are overlooked.** Unless these concerns can be met, it should be assumed that tailings ponds at the Pebble mine would have dangerously low pH and high levels of dissolved metals.

1. "The pyrite-rich tailings would be encapsulated in non-acid-generating tailings" (EPA 2012, p.4-19). But **it is not clear how these tailings would be sealed permanently from the overlying water**. Pond water is likely to reach acid-forming, metal-contaminated tailings through crevices in the "encapsulating" layer; as ion concentrations equalized, contamination of the pond would gradually increase. **Oxidation of contaminants in pond water would be assured,** due to regular mixing of this water (see next paragraph).

2. Tailings would be covered "with a water cap maintained in perpetuity to retard oxidation of sulfide minerals" (EPA 2012, p.4-19). **However, it is not clear how this cap of clean water could be maintained**.

- **Sediment-laden water will be added continually** to the pond during operations. Even though it "would be discharged below the water surface" (EPA 2012, page 4-21), **this inflow will create constant turbulence in the pond**. Oxidation of these sediments will proceed rapidly in the well-mixed water; and birds and other wildlife will have access to the pond.

- **No clean "water cap" will remain on the pond after mine closure, under foreseeable conditions.** All water bodies **are mixed by the wind**, which occurs often in Alaska. Furthermore, all water bodies undergo **seasonal overturn**, which mixes them top-to-bottom as deep as several hundred feet (Smith 1973, Schultz 2012). It can be assumed that these conditions will apply to Pebble's tailings ponds.

3. "In a TSF . . . trace amount [*sic*] of carbonate or silicate minerals will partially neutralize acid" in mine waters (EPA 2012, page 4-23). But **the capacity of water in the Pebble area to neutralize sulfuric acid is limited,** since it is "soft" water with very low contrations of buffering salts.

Pit lakes will contain extremely toxic water

Water in the mine pit would be acidic and would be contaminated with metals (EPA 2012, page 4-31). This water would leach into the surrounding groundwater, especially as the water level rose over the long term. EPA states that oxidation (i.e., acidification) would be minimized as the pit filled. However, filling would take many decades; in any case, **acidification would continue indefinitely** (Eisler and Wiemeyer 2004). Although the quality of pit water varies widely, examples of toxic pit lakes are numerous (Braun 2002).

Impacts to birds of tailings ponds and pit lakes

Flocks of waterfowl regularly land in water bodies, including mine-created ones. Birds are unable to detect contamination when landing on hazardous ponds, and they may remain long enough to ingest lethal levels of acid and metals. Even if birds fly away before they are killed outright, internal injuries may reduce their survival under natural conditions (Hooper et al. 2007). In addition, tailings ponds may attract more birds if they incorporate "beaches" on their perimeter (EPA 2012, page 4-10). Although waterfowl

often land in ponds with steep shorelines, the "beaches" will make the ponds accessible shorebirds and land birds.

Waterfowl are killed occasionally in tailings ponds. In the year 2000, 221 birds were killed in Arizona and New Mexico in tailings ponds that contained 5840 milligrams per liter of copper, plus other toxic metals (Hooper et al. 2007).

Birds have been killed in pit lakes. At least one instance is known of a mass bird kill in a pit lake, at the Berkeley pit near Butte, Montana in 1995. A flock of Snow Geese landed in the lake, and 331 birds died (NAS 1999).

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